Fiscal rules and Government borrowing costs

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FISCAL RULES AND GOVERNMENT BORROWING COSTS: INTERNATIONAL EVIDENCE

ABSTRACT

We find that the adoption of numerical fiscal rules reduces government borrowing costs in a sample of 101 advanced and developing countries for 1985-2010. We apply a variety of propensity score matching methods to address the self-selection problem of policy adoption and find strong evidence that fiscal rules have large and significant treatment effects on lowering government borrowing costs in both international and domestic financial markets. The results are robust to changes in country sample and alternative estimation methodology, and are consistent with fiscal rules helping to build policy credibility by reducing the probability of default and the "risk premium" on government debt that compensates lenders for this possibility, (JEL E43, G12, H60).

I. INTRODUCTION

Numerical fiscal rules have been a popular addition to fiscal frameworks since the early 1990s.[1] In this paper, we examine whether the adoption of such rules has had a beneficial impact on government borrowing costs in international and domestic credit markets. Given the considerable executive and legislative effort involved in the adoption of rules, whether or not their adoption has impacted on borrowing costs is pertinent. The main reason for believing that they might do so is if numerical rules add to fiscal policy credibility and reduce the risk premium on government debt. If they do, we would expect this to be reflected in lower borrowing costs in credit markets for governments that have adopted a rule compared to the costs for

governments that have not adopted a rule. In addition, we would expect government borrowing costs to decline even with respect to other (private sector) borrowers more generally. We examine these propositions in the context of developments in "spreads" for government borrowing in international and domestic credit markets.

In the international market, government borrowing costs are represented by the spread between the rate at which a country borrows and the "risk free" interest rate, defined as the yield on long-term (10-year) US Treasury bonds. In this market, the interest rate paid by governments is typically higher than the yield on U.S. bonds. If the adoption of fiscal rules adds to policy credibility then, ceteris paribus, we would expect the yield the government would need to offer on its bonds to decline relative to the US yield—i.e., the spread on borrowing in the international market would decline. In the domestic market, we focus on the spread between the interest rate charged by domestic banks on loans to private sector entities and the interest rate at which governments can borrow through the issuance of short-term securities. In this market, the cost of borrowing by the government is typically lower than it is for private sector entities. Accordingly, if adopting fiscal rules reduces the risk premium on government borrowing, we would expect this spread to widen as the cost of borrowing by the government declines relative to that of private sector entities.

Our paper makes two contributions to the literature on fiscal rules and borrowing costs. First, we deal with an important econometric issue in evaluating the effect of fiscal rules, which is the non-random selection of policy options that arises when a country's fiscal policy regime choice is systematically correlated with a set of observable variables that also affect the outcomes and that can lead to biased

estimates. Many of the studies of the impact of fiscal rules have failed to address this issue. We address it by evaluating the treatment effect of numerical fiscal rules on borrowing costs in a panel dataset of countries, many of which have adopted numerical fiscal rules in recent years. Second, the little empirical evidence that has been published on the impact of fiscal rules on borrowing costs relates mainly to the experience of US states and European Union countries. In contrast, our dataset contains annual observations for 101 advanced and developing countries for the period 1985-2012, of which 44 countries adopted a numerical rule on the fiscal balance and/or the stock of public debt.

To anticipate our baseline results, we find the average treatment effect on government borrowing costs of adopting a fiscal rule to be strong and robust, leading to on average to a reduction in the relative cost of borrowing by the government of between 1.1-1.8 per cent of the borrowing spread in international credit markets and between 1.2-1.9 per cent of the borrowing spread in domestic credit markets. Those countries that have already adopted fiscal rules, or are considering adopting them, should find our results encouraging.

The rest of the paper is organized as follows. In the next section we discuss briefly some key issues in fiscal rule adoption and some of the empirical evidence on the impact of fiscal rules generally and on government borrowing costs in particular. Section III describes our methodology and data. Our empirical results are presented in Section IV and Section V concludes.

II. FISCAL RULES: BACKGROUND AND EVIDENCE

The increased use of fiscal rules reflects concerns about a so-called 'deficit bias' in fiscal policy that results from governments' short sightedness and the 'common pool' problem.[2] The short sightedness derives from governing party concerns about electoral prospects that may lead to insufficient attention being paid to longer-term budgetary requirements (Persson and Svensson, 1989), or to governments opportunistically raising spending or cutting taxes to increase their prospects for re-election (Rogoff, 1990), or to governments raising public debt levels so as to limit future governments' room for manoeuvre in fiscal policy (Alesina and Tabellini, 1990). The common pool problem occurs because special interest groups fail to internalize the overall budgetary impact of their competing demands (Weingast, Shepsle, and Johnsen, 1981; Wyplosz and Kostrup, 2010). One way to mitigate fiscal deficit bias is to adopt numerical fiscal rules that impose binding constraints on the conduct of fiscal policy. This involves setting a numerical target over some time period to guide fiscal policy, and the specification of a summary operational fiscal indicator to which the rule is applied (Kopits and Symansky, 1998). In practice, countries adopting fiscal rules have typically opted for rules that are linked closely to debt sustainability, with the most common rules specifying some measure of budget balance (overall balance, structural or cyclically adjusted balance, or balance 'over the business cycle'), an explicit limit on, or target for, public debt, a limit on primary or current government spending, or a minimum level of government revenues aimed at boosting revenue collection and/or preventing an excessive tax burden.[3]

The empirical evidence on the gains from adopting fiscal rules is mixed. Several papers offer supporting results with respect to post-rule adoption fiscal performance, including: that targeting the budget balance or general government debt can have a

significant and sizeable impact on limiting fiscal deficits (Debrun, Moulin, Turrini, Ayuso-i-Casals, and Kumar, 2008); that expenditure rules can be effective in restraining primary spending (Deroose, Moulin, and Wierts, 2008), including by limiting upward pressure on expenditure due to unexpected revenue windfalls (Wierts, 2007); that their impact is more favourable if rules have a strong legal and institutional basis and are enforced strictly (von Hagen, Hallerberg, and Strauch, 2007); and that rules can contribute to successful fiscal consolidation (Guichard, Kennedy, Wurzel, and Christophe, 2007). However, other studies report that significant breaks in fiscal performance appear to have preceded the adoption of fiscal rules (Caceres, Corbacho, and Medina, 2010) and that there appears to have been no improvement in the fiscal performance of emerging market economies that did not adopt them compared to those that did (Thornton, 2009). Also, there are several operational problems that complicate the effective implementation of fiscal rules. In particular: the rules need to be flexible enough to accommodate unforeseeable situations that may arise that would make any rule too costly to respect—for example, in the context of the cumulative increases in public debt in many high-income countries following the 2007 financial crisis; they can often be manipulated—for example, in estimating the cyclical correction inherent in any rule to balance the budget over the business cycle; they can be subject to arbitrage when, as is common practice, more than one fiscal rule is adopted; and they may not be effective unless they are complemented by a strong political commitment or by domestic budgetary institutions (von Hagen, Hallerberg, and Strauch, 2007; Wyplosz, 2013).

Research on the impact of fiscal rules on government borrowing costs has been quite limited. A theoretical basis for adopting fiscal rules to reduce borrowing spreads is

providing in a series of papers by Hatchondo and co-authors that extend the Eaton and Gersovitz (1981) sovereign debt default framework to include long-term debt. For example, Hatchondo and Martinez (2009) present a model in which governments issuing bonds with a duration like the average for emerging market countries face an interest rate that is substantially higher and more volatile compared to when only short term debt is issued. Hatchondo, Martinez, and Padilla (2011) demonstrate the importance of debt dilution in accounting for the level and volatility of the interest rate spread paid by sovereigns; and Hatchondo, Martinez, and Roch (2015) show how introducing a fiscal rule lowers sovereign risk and generates welfare gains because the rule limits debt dilution.[4] With the fiscal rule, lenders expect lower future government debt levels, which accounts for the decline in interest rates at which the government can borrow. Thus, for a given level of indebtedness, the government is able to borrow paying at a lower interest rate.

Empirical evidence on the impact of fiscal rules on borrowing spreads relates almost exclusively to the experience of US states and some European economies. For the US, this evidence includes: Eichengreen and Bayoumi (1994) and Bayoumi, Goldstein, and Woglom (1995), who report that constitutional restraints to borrowing reduce the costs of borrowing by US states; Poterba and Rueben (1999ab), who find that rules on US states' expenditure, deficits, and debt reduce their borrowing costs except when a state also imposes limitations on the ability to raise taxes; Poterba and Rueben (2001), who find that a sudden increase in the fiscal deficit raises state financing costs, but that the rise is smaller if the state has a strict fiscal rule; and Johnson and Kriz (2005), who find that numerical fiscal rules reduce borrowing costs but that the effect operates indirectly by improving credit ratings. For European countries, the evidence

includes Iara and Wolf (2014), who report that numerical rules only impact on borrowing costs of euro area countries at times of market stress; Heinemann, Osterloh, and Kalb (2014), who find that the impact of numerical rules on euro area countries is less important once historical fiscal preferences are considered; and Feld, Kalb, Moessinger, and Osterloh (2012), who find a robust negative effect of fiscal rules on bond spreads for Swiss cantons.

In sum, many countries have adopted fiscal rules to support fiscal discipline and build policy credibility but the evidence that rules have strong effects in these regards is mixed, including on government borrowing costs. One issue with the approach taken in many of the empirical studies discussed above is that they typically search for rule effects by incorporating a fiscal rule adoption dummy into a data panel and examining the statistical significance and sign of the coefficient on the dummy. Although we also present some estimates of this type from a cross-country panel of countries that are broadly consistent with fiscal rules on debt and fiscal deficits leading to lower borrowing costs for governments in international and domestic credit markets, a problem with this approach is that it ignores the self-selection problem of policy that arises when a country's policy choice is non-random In particular, systematic correlation between the policy choice and other covariates will cause the selection on observables problem, which can lead to biased estimates. In fact, we find evidence for the existence of this problem in probit estimates indicating that fiscal rule adoption is systematically correlated with variables such as macroeconomic performance, past fiscal performance, the level of financial development, and the exchange rate regime. In the next section, we discuss how we address the self-selection problem by making use of propensity score-matching methods developed in the treatment effect literature.

III. DATA AND METHODOLGY

A. Data

Data on bond spreads are from Fouejieu and Roger (2013), which we have updated from the IMF's International Financial Statistics database and Bloomberg, and data on domestic borrowing spreads are from the World Bank's World Development indicators database.[5] Figures 1 and 2 illustrate borrowing spreads in the international and domestic credit markets, respectively, for countries with and without fiscal rules for the years 1985-2012. International bond spreads moved reasonably closely together for the rule adopting and non-rule adopting countries over the period; in the domestic markets, the spreads for non-rule adopting countries were substantially higher at times but narrowed sharply late in the sample period in line with the spreads for rule adopting countries.

We draw on IMF (2009) and Schaechter, Kina, and Weber (2012) for a listing of countries that have adopted numerical fiscal rules and the dates of adoption. Data on annual fiscal balances is from Mauro, Romeu, Blinder, and Zaman (2015) and the IMF's World Economic Outlook (WEO) database, and on public debt it is from Abbas, Belhocine, El Ganainy, and Horton (2010) and the WEO database; and data on macroeconomic variables is from the World Bank's World Development Indicators database. In addition, we have drawn on Reinhart and Rogoff (2004) and Ilzetzki, Reinhart, and Rogoff (2008) for the exchange rate regime classification (their coarse grid categorization, which ranges from 1 [least flexible] to 5 [most flexible]); on Hammond (2012) for information on inflation targeting adoption; and on the CIA Factbook for information on whether countries have federal or unitary fiscal systems.

Our dataset contains annual observations for 101 advanced and developing countries for the period 1985-2012, of which 44 countries adopted a numerical rule on the fiscal balance and/or the stock of public debt.

B. Methodology

a. Panel estimation

In the previous section, we noted that past empirical studies of the impact of fiscal rules on borrowing spreads typically searched for fiscal rule effects by incorporating a fiscal rule adoption dummy into a data panel to examine the statistical significance and sign of the coefficient on the dummy variable. We follow this practice with our first set of estimates, which are based on a model that embeds a fiscal rule dummy in a standard model (e.g., Edwards, 1986; Bellas, Papaioannou, and Petrova, 2010; Baldacci, Gupta and Mati, 2011; Fouejieu and Roger, 2013) of the main determinants of sovereign spreads. The model is specified as:

$$Spread_{it} = \alpha_i + \theta_i + \beta X_{it} + \varepsilon_{it} \qquad (1)$$

where α_i is country i's country fixed effect on the sovereign risk premium, θ_i is the time fixed effects, X_{it} is a vector of variables that effects sovereign risk, and ε_{it} is a random error term. X_{it} includes the (0-1) dummy variable indicating adoption of a fiscal rule on the fiscal balance or stock of debt and several variables used commonly in the empirical literature. They are: the stock of public debt in relation to GDP and the fiscal balance in relation to GDP, which are expected to increase the risk premium since they raise the probability that the country will be unable or unwilling to service its debts; per capita GDP, because default risk has typically been greater for

developing than developed economies; GDP growth, which is a key indicator of macroeconomic stability and where higher growth is expected to reduce sovereign risk; inflation, where a high rate is expected to increase sovereign risk because it can signal the need for higher interest rates and thus an increase in the cost of capital; openness to international trade (measured as exports plus imports in relation to GDP), which is expected to increase sovereign risk because of the greater vulnerability to external shocks; the ratio of foreign exchange reserves in relation to GDP, which is expected to lower the risk premium since a country's capacity to service its external debt or absorb a negative shock is improved; and exchange rate volatility (measured as the standard deviation of the monthly per cent change in the exchange rate), which is expected to be positively correlated with sovereign risk since it increases the uncertainty about the debt service outstanding.

b. Treatment effects and selection bias

Equation (1) gives rise to an important econometric issue in evaluating the effect of fiscal rules when the decision to adopt a fiscal rule framework is not random. If fiscal rule adoption is systematically correlated with a set of variables that also affect the outcomes, then we will have the selection on variables problem, which makes linear regression with a fiscal rule adoption dummy an unreliable method.[6] At least two sources of endogeneity seem likely. The first is possible inverse causality between some covariates and borrowing spreads. For example, since fiscal policy can affect the sovereign risk premium, the fiscal authorities in some countries may adjust their fiscal and other policies to avoid increasing the sovereign risk premium. In this case, the fiscal position would be driven partly by the sovereign risk premium rather than

the converse. The second source of endogeneity could be omitted variable bias, since we cannot control for all the determinants of sovereign risk.

To address the self-selection problem, we make use of different propensity score matching methods that have been developed in the treatment effect literature and have been applied to macroeconomic issues, for example, in a series of papers by Lin and Ye (2007, 2009, 2010, 2013), Glick, Guo, and Hutchinson (2006), Persson (2001), and recently by Thornton and Vasilakis (2017). In our case, the objective is to evaluate the treatment effect of numerical fiscal rules in countries that have adopted such a rule. To estimate the average treatment effect on the treated (ATT), we consider the following equation:

$$ATT = E[Y_{i1}|D_i = 1] - E[Y_{i0}|D_i = 1] \qquad (2)$$

where D is the numerical fiscal rule dummy, $[Y_{i0}|D_i = 1]$ is the value of the outcome that would have been observed if a fiscal rule adopter country had not adopted such a framework, and $[Y_{i1}|D_i = 1]$ is the outcome value that is observed in the same country. The difficulty in estimating ATT is that the second term on the right-hand side $E[Y_{i0}|D_i = 1]$ is not observable. We cannot observe developments in borrowing spreads in a fiscal rule adopting country had it not adopted such a regime. If a country's choice of fiscal policy framework was random, one could obtain ATT by comparing the sample mean of the treatment group (fiscal rule adopters) with that of the control group (non-rule adopters). If the decision to adopt a fiscal rule framework were not random, then we would have the selection on observables problem. This can be addressed by making use of propensity score matching methods. The main idea of

matching is to use a control group to mimic a randomized experiment. The assumption needed to apply the matching method is the conditional independence assumption $(Y_0, Y_1 \perp D|X)$, which requires that conditional on X, the outcomes be independent of the fiscal rule dummy. Under this assumption, Equation (2) can be rewritten as:

$$ATT = E[Y_{i1}|D_i = 1, X_i] - E[Y_{io}|D_i = 0, X_i] \qquad (3)$$

in which $E[Y_{i0}|D_i = 1, X_i]$ is replaced with $E[Y_{io}|D_i = 0, X_i]$, which is observable.

One matching method would be to match the treated countries to the control countries with similar values of X. As the number of covariates in X increases, matching on X would be difficult to implement in practice. To deal with this problem, we follow Lin and Ye (2007, 2009, 2010, 2013) and match the treated units and the control units on their propensity scores. The propensity score is the probability of policy adoption conditional on X and can be estimated using a simple probit or logit model. A further assumption needed for the validity of propensity score matching is the common support assumption $(p(X_i) < 1)$, which requires the existence of a comparable control group of countries for the treated countries. When propensity score matching is used, the ATT can be estimated as:

$$ATT = E[Y_{i1}|D_i = 1, p(X_i)] - E[Y_{i0}|D_i = 0, p(X_i)] \qquad (4)$$

We employ four commonly used propensity score matching methods. The first is the nearest-neighbour matching with replacement, which matches each treated country to

n control countries that have the closest propensity scores. We use two nearest-neighbour matching estimators: n=1 and n=3. The second method is radius matching, which performs the matching based on estimated propensity scores falling within a certain radius. We employ a wide radius ($r = 0.05$), a medium radius $r = 0.03$), and a tight radius $r = 0.01$). The third method is the kernel matching method, which matches a treated group country to all control group countries weighted in proportion to the closeness between the treated group country and the control group country. The final method is the regression adjusted local linear matching method.[7]

IV. EMPIRICAL RESULTS

A. Panel Results

The panels for estimating equation (1) contain up to 28 countries for international bond spreads and 46 countries for domestic lending spreads. The methodology is ordinary leas squares with fixed time and country effects. The results are reported in Table 1 and provide some support for a positive impact of fiscal rules on domestic and international borrowing costs. The fiscal rule dummies are all statistically significant, though only at the 10% level, with rules acting to reduce spreads in international credit markets and widen them in domestic credit markets. The results indicate that inflation, per capita GDP, and exchange rate volatility are the other key determinants of borrowing spreads, with the signs on the coefficients being as hypothesized. However, as discussed above, we suspect these results to be biased because of endogeneity.

B. Estimating the Average Treatment Effects on borrowing costs

The two treatment groups in our study comprise a total of 44 advanced and developing economies that had adopted a numerical fiscal rule for the fiscal balance or for public debt by the end of 2012.[8] Our control groups in both cases comprise 67 countries that did not adopt a fiscal rule of any type. Tables 2 and 3 list the countries in the treatment and control groups for international bond spreads and domestic borrowing spreads, respectively.[9]

Propensity scores

The first step is to test for factors that increase the probability that a fiscal rule will be adopted. To this end, we employ a panel binary response model to test for factors that increase the probability that a fiscal rule will be adopted. In the model, the dependent variable y_{it} $(i = 1, \dots N; t = 1, \dots T)$ is a dummy variable that takes the value 1 if a country i adopted a fiscal rule in year t, and 0 otherwise.[10] As there are unobserved characteristics, the appropriate specification is a panel probit model with random effects that is estimated using maximum likelihood. Our general model is:

$$y_{it}^{*} = \alpha + \beta' EC_{i,t-1} + \gamma' INS_{i,t-1} + \mu_i + \varepsilon_{it} \qquad i = 1 \dots N; t = 1, \dots T \quad (4)$$

where $y_{it} = 1$ if $y_{it}^{*} > 0$, $y_{it} = 0$ if $y_{it}^{*} \geq 0$; y_{it}^{*} is an unobserved latent variable that describes the decision to adopt a fiscal rule, β and γ are vectors of parameter estimates, μ_i is the unobserved random effect, uncorrelated with explanatory variables, ε_{it} is a normally, independently, and identically distributed error term with mean 0 and variance 1; and $EC_{i,t-i}$ and $INS_{i,t-i}$ are, respectively, economic and institutional explanatory variables. Following common practice, we include a 1-year lag of the explanatory variables to avoid potential endogeneity.

The probability of adopting a fiscal rule is given as:

$$P(y_{it} = 1 x_{i,t-i} \mu_i) = \phi[\alpha + \beta' EC_{i,t-i} + \gamma' INS_{i,t-i} + \mu_i] \qquad (5)$$

where $\phi(.)$ is a standard normal cumulative distribution function.

The economic and institutional variables that we include are drawn from of recent work that throws light on key factors behind a country's decision to adopt a fiscal rule as summarized in Altunbaş and Thornton (2017). For example, Debrun and Kumar (2007) and Roubini and Sachs (1989) cite large and persistent fiscal deficits and growing public debt as a justification for the introduction of fiscal rules; the IMF (2009) reports evidence that fiscal rules tend to be introduced in countries that have already made progress in achieving fiscal and economic stability This literature has also highlighted the importance of monetary regimes in the decision to adopt a fiscal rule. For example, Combes, Debrun, Minea, and Tapsoba (2014) report that interactions between fiscal rules and inflation targets are important for policy outcomes with countries that combine fiscal rule adoption and inflation targeting delivering more disciplined macroeconomic policies than each of these institutions in isolation;[11] Prud'homme (1995) and Webb (2004) attest to important differences in the conduct and outcome of fiscal policy between federal and unitary countries; and Giavazzi and Pagano (1988) and Frenkel, Goldstein, and Masson (1991) discuss the impact of government deficits and public debt levels on the relative success of different exchange rate regimes; and Bova, Carcenac, and Guerguil (2014) report that fiscal rules were sometimes adopted as part of the toolkit to join currency unions.[12]

Thus, this literature suggests that the probability of a country adopting a fiscal rule is greater if it has a high level of public debt, if economic conditions are relatively stable, if it is relatively open to international trade and its exchange rate regime is relatively inflexible, if it is decentralized fiscally, if the monetary framework embraces inflation targeting, and if the country is a member of a currency union. Accordingly, we include in our baseline probit estimation: the ratio of public debt to GDP; the rate of inflation, the rate of real GDP growth, real GDP per capita; the relative flexibility of the exchange rate regime openness to international trade (exports plus imports as a per cent of GDP); and three 0-1 dummy variables to indicate whether a country is a federation, has adopted an inflation targeting regime, and is a member of a currency union.

The baseline probit results are reported in the columns (1) and (3) of Table 4 and generally confirm our expectations. Broadly, the probability of a country adopting a numerical rule on the fiscal balance or the stock of public debt is greater if the stock of public debt, GDP growth, and GDP per capita are relatively high, the economy is relatively open, if an inflation targeting regime is in place, if it is a member of a currency union, if it is a federation, and if the exchange rate regime is relatively inflexible and if inflation is relatively low.

Results from matching

The estimated average treatment effect on the treated (ATTs) for the relative cost of borrowing is reported in Tables 5 and 6 for the fiscal balance and for the public rule, respectively. The results for international bond spreads are in line 1 of panel A in each

table and those for domestic spreads are in line 1 of panel B of the tables. In the case of international bond spreads, the ATTs are negative, highly statistically significant and quite large in magnitude for both rules. The average borrowing spread narrows by between 1.5-1.8 per cent for the fiscal balance rule, and between 1.1-1.2 per cent for a rule on the public debt. That is, the international borrowing spread narrows following the adoption of a fiscal rule, which we interpret as reflecting a fall in the cost of borrowing incurred by the government in the international credit market. In the case of domestic borrowing spreads, the ATTs are positive, highly statistically significant, and quite large in magnitude for both rules, with the average borrowing spread widening between 1.5-1.8 per cent for the fiscal balance rule, and between 1.1-1.4 per cent for a rule on the public debt. That is, the domestic borrowing spread widens following the adoption of a fiscal rule, which we interpret as reflecting a fall in the cost of borrowing by the government in the domestic credit market. Thus, numerical fiscal rules have quantitatively statistically significant and quite large effects on lowering the relative cost of borrowing by governments in international and domestic credit markets.

Robustness checks

We carry out several robustness checks on our results.[13] First, we take account of the fact that many countries in our sample received debt reduction over the period either because of multilateral debt relief initiatives or as the outcome of bilateral negotiations with official and private creditors. For some countries, the debt reduction was very large—for example, accumulating in current US dollars to the equivalent of over 100% of 2012 GDP.[14] Debt reduction influences the recipient country's debt stock and its fiscal balance because of the associated reduction in interest payments

and would likely bias our baseline results. Probit results including debt reduction are reported in columns 2 and 4 of Table 4. The coefficients on debt reduction are statistically significant and negative, indicating that countries that experienced debt relief are less likely to adopt a fiscal rule. The associated matching results in these cases are reported in line 2 of panels A and B in Tables 5 and 6. There is little impact on the results for both type of fiscal rule: the estimated ATTs remain negative, statistically significant, and of a similar magnitude for international bond spreads, and positive, statistically significant, and of a similar magnitude for domestic borrowing spreads. As such, the adoption of fiscal rules has a significant impact in reducing elative government borrowing costs in international and domestic credit markets even after controlling for debt reduction.

As a second robustness check, we take account of the fact that developed and developing economies are likely to have different institutional capabilities that might influence their ability to commit to or to enforce fiscal rules.[15] This might result in bias results in favour of a positive impact from fiscal rules if the sample included an over-representation of high-income countries. To test for this possibility, we report separate results for high-income and other (developing) economies in which we classify "high-income" according to the World Bank's country income classification criteria.[16] These results are reported in lines 3 (high-income) and 4 (developing), respectively, of panels A and B, in Tables 5 and 6. The results by these country classifications confirm those for the full sample of countries: the coefficients are of the expected sign and are statistically significant for almost all tests for international and domestic spreads for both types of fiscal rule, though they are somewhat weaker in the case of the debt rule for developing economies where statistical significance is

frequently only at the 10% level. The general impression from these results is that high-income countries benefit slightly more than developing economies from the impact of fiscal rules on spreads—that is, the reduction in spreads in the international credit market, and the widening of spreads in the domestic credit market are somewhat larger for these countries.

As a third robustness check, we try to adjust for the fact that, except for Greece, member countries of the Eurozone displayed a near zero risk spread in international credit markets over most of the sample period. Accordingly, in line 5 of panels A and B in tables 5 and 6 we report results excluding Eurozone countries from the sample. The results support our general conclusion as to the impact of fiscal rules on spreads—that is, the coefficients are of the expected sign and most remain statistically significant, though at times only at the 10% level. As a fourth and related robustness test, we exclude from the sample four countries—the US, the UK, Japan and Germany—for whom default risk was of negligible concern over the sample period (in that they consistently had the highest credit ratings) because their inclusion might bias the results in favour of finding an effect from fiscal rules on borrowing risk. These results are reported in line 6 of the two panels in tables 5 and 6 and are broadly in line with those for the full sample of countries.

Our fifth and final robustness test is to try to account for the possibility that the impact of fiscal rules on borrowing spreads might only be temporary—for example, because a rule adopted during an administration that pushes for fiscal restraint might have the greatest impact on borrowing costs while that administration is in office, but a weaker impact later under a new administration less committed to, and less likely to

enforce, fiscal rules. We try to account for this possibility by limiting the sample to observations 5-year intervals (i.e., 1985, 1990, 1995, etc.), which should go some way to exposing any temporary effects of fiscal rules. These results are reported in line 7 of the panels in tables 5 and 6 and are consistent with fiscal rules having had a long-run impact on borrowing spreads, though the statistical significance of the coefficients falls to 10% in several cases.

V. CONCLUSIONS

In this paper, we evaluated the treatment effects of adopting numerical fiscal rules on the cost of borrowing by governments in international and domestic financial markets. Using traditional panel estimates and different propensity score matching methods, we show that the adoption of a numerical rule on the fiscal balance or the stock of public debt resulted in large and statistically significant reduction in the relative costs of borrowing by governments in international and domestic financial markets. In international markets, the governments' cost of borrowing falls with respect to the interest rate on US government bonds, and in the domestic market it falls with respect to the interest rate charged by domestic banks on loans to private entities. The results were robust to alternative country samples and alternative estimation methodology. We view our results as consistent with the adoption of numerical fiscal rules helping build policy credibility and thereby reducing the probability of government default and reducing the "risk premium" on government debt that compensates lenders for this possibility. Our results should be of interest to governments that have already adopted or are considering adopting numerical fiscal rules in the hope of, among other objectives, reducing their borrowing costs.

FOOTNOTES

1. For example, the IMF (2009) estimates that by the end of 2009, 80 countries had adopted national and supranational numerical fiscal rules to guide fiscal policy.

2. See Abbas, Belhocine, El Ganainy, and Horton (2010) and Mauro, Romeu, Blinder, and Zaman (2013) for discussions of long-run developments in fiscal deficits and public debt in large samples of countries.

3. Many countries that have adopted fiscal rules have opted for more than one rule, with some countries having rules pertaining to a measure of budget balance and to the public debt-to-GDP ratio.

4. Debt dilution refers to the reduction in the value of existing debt triggered by the issuance of new long-term debt since rational investors anticipate that additional borrowing by future governments will increase the risk of default on long-term bonds issued by the current government and, thus, offer a lower price for these bonds.

5. We are grateful to Armand Fouejieu and Scott Roger for making their database available.

6. Dehejia and Wahba (2002) and Heckman, Ichimura, and Todd (1998) provide detailed discussions.

7. These propensity score matching techniques are discussed in detail in Lin and Ye (2007).

8. As some countries adopted numerical rules for the fiscal balance and the level of public debt, there is some overlap of countries in the two treatment groups.

9. The number of countries included in the treatment and control groups is constrained by the limited availability of long runs of interest rate spread data in international and domestic credit markets.

10. See Cameron and Trivedi (2005) and Baltagi (2008).

11. Several countries in our sample shifted to inflation targeting monetary regimes, including Ghana, Guatemala, Indonesia, Peru, and the Philippines (Hammond, 2012).

12. Our sample includes eight countries that are members of the West Africa CFA currency union and five that are members of the Central Africa CFA currency zone.

13. We are grateful to an anonymous referee of the journal for suggesting some of these robustness tests.

14. Of the countries in our sample, Ethiopia, Guyana, Liberia, Madagascar, Mozambique, Nicaragua, Sierra Leone, São Tomé and Principe, and Zambia received debt reduction to the equivalent of over 100% of 2012 GDP during 1985-2012.

15. We estimate a different binary response model to test for factors that increase the probability that a fiscal rule will be adopted for each additional robust test of ATT results but do not report the results for reasons of parsimony. The results are available on request.

16. For example, in 2012, the last year of our sample, the World Bank country classification scheme listed countries with a per capita GNI of $12,615 or above as ‘high-income.’ The countries grouped as high-income according to the Bank’s classification did not change over the sample period.

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TABLE 1

The Determinants of Bond Spreads: Panel Regressions

	International spreads		Domestic spreads	
Fiscal deficit rule	-3.0566*		1.6634*	
	(1.5484)		(0.8661)	
Public debt rule		-2.6890*		2.1163*
		(1.5542)		(1.0673)
Pubic debt to GDP	0.0336	0.0335	0.0061	0.0067
	(0.0230)	(0.0258)	(0.0177)	(0.0176)
Fiscal deficit to GDP	-0.2336	-0.1841	-0.0382	-0.0441
	(0.2184)	(0.1989)	(0.1034)	(0.1024)
GDP per capita (log)	-10.0490*	-8.1778*	5.7666**	5.9017**
	(5.8000)	(4.6614)	(2.7755)	(2.6669)
GDP growth	-0.9170	-0.8309	0.2198*	0.2037*
	(0.7295)	(0.6870)	(0.1127)	(0.1103)
Inflation	0.0706***	0.0660***	0.6903***	0.6922***
	(0.0085)	(0.0114)	(0.1393)	(0.1377)
Trade openness	0.2492	0.2153	-0.0109	-0.0136
	(0.1579)	(0.1503)	(0.0328)	(0.0330)
Foreign reserves to GDP	-0.5597*	-0.3284	0.0179	0.0163
	(0.3310)	(0.2323)	(0.0376)	(0.0375)
Exchange rate volatility	0.5776***	0.6851***	0.2416	0.2455
	(0.0895)	(0.1211)	(0.3211)	(0.3211)
Intercept	85.1289	70.2705	50.8437**	55.2212*
	(55.9093)	(54.5556)	(25.2906)	(25.7115)
Fixed effects	Yes	Yes	Yes	Yes
R^2	0.258	0.270	0.496	0.488
Observations	440	480	906	906
Countries	26	28	46	46

Note: Panel least squares estimates with fixed effects. ***, **, and * indicate statistical siignificance at the 1, 5 and 10% levels, respectively.

TABLE 2

Treatment and Conrol Group Countries for International Bond Spreads

1. Fiscal balance rule treatment group

Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Latvia, Malta, Mexico, Netherlands, Norway, Pakistan, Peru, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom

2. Public debt rule treatment group

Armenia, Australia, Austria, Belgium, Denmark, Estonia, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Lithuania, Malta, Namibia, Netherlands, Pakistan, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom

3. Common control group

Botswana, Burundi, Chile, China, Colombia, Egypt, Ethiopia, Fiji, Ghana, Iceland, Japan, Jordan, Kazakstan, Korea, Malaysia, Moldova, Morocco, Nepal, Papua New Guinea, Philippines, Russia, Seychelles, Singapore, Sierra Leone, South Africa, Thailand, Turkey, United States, Venezuela

Sources: Data on countries with a fiscal rule is from IMF (2009) and Schaechter, Kinda, Budina, and Weber (2012).

TABLE 3

Treatment and Conrol Group Countries for Domestic Borrowing Spreads

1. Fiscal balance rule treatment group

Argentina, Brazil, Bulgaria, Canada, Czech Republic, France, Hungary, Israel, Italy, Latvia, Madagascar, Mexico, Malta, Nigeria, Pakistan, New Zealand, Romania, Sweden, Switzerland, United Kingdom

2. Public debt rule treatment group

Armenia, Antigua & Barbuda, Australia, Belgium, Cote d'Ivoire, Czech Republic, Dominica, Greneda, Hungary, Italy, Kenya, Latvia, Lithuania, Malta, Mauritius, Namibia, New Zealand, Pakistan, Poland, Romania, Slovenia, St. Kitts & Nevis, St. Lucia, Sri Lanka, St. Vincent & the Grenadines, Sweden

3. Common control group

Algeria, Angola, Azerbaijan, Bahrain, Barbados, Belize, Bolivia, Burundi, Egypt, Ethiopia, Fiji, Gambia, Georgia, Guyana, Iceland, Jamaica, Japan, Kyrgyz Republic, Lao PDR, Lethoso, Madagascar, Malaysia, Mauritania, Moldova, Mongolia, Mozambique, Nepal, Philippines, Papua New Guinea, Russia, Seychelles, Sierra Leone, Singapore, South Africa, Swaziland, Tanzania, Thailand, Trinidad & Tobago, Uganda, United States, Uruguay, Vietnam, Yemen, Zambia, Zimbabwe

Sources: Data on countries with a fiscal rule is from IMF (2009) and Schaechter, Kinda, Budina, and Weber (2012).

TABLE 4

Probit Estimates of Propensity Scores for Numerical Fiscal Rules: Full Sample

	Fiscal balance rule		Public debt rule	
	(1)	(2)	(3)	(4)
Lagged public debt	0.0035***	0.0009*	0.0014**	0.0005
	(0.0007)	(0.0005)	(0.0007)	(0.0008)
Inflation	-0.0284***	-0.0341***	-0.0363***	-0.0418***
	(0.0059)	(0.0090)	(0.0055)	(0.0068)
GDP growth	0.0017	0.0003	0.0018	0.0129
	(0.0064)	(0.0077)	(0.0061)	(0.0076)
GDP per capita	0.0941***	0.0860***	0.1267***	0.1138***
	(0.0197)	(0.0235)	(0.0213)	(0.0252)
Trade to GDP	-0.0005	-0.0019**	-0.0022**	-0.0034**
	(0.0007)	(0.0009)	(0.0008)	(0.0010)
Exchange rate regime	-0.2486***	-0.2616***	-0.4311***	-0.4717***
	(0.0399)	(0.0492)	(0.0496)	(0.0569)
Inflation targeter	0.9945***	1.0270***	0.8525***	0.9108***
	(0.0990)	(0.1160)	(0.1122)	(0.1323)
Currency union member	0.0865***	0.8469***	1.2031***	1.1869***
	(0.0630)	(0.0728)	(0.0659)	(0.0801)
Ferderation	0.5542***	0.4449***	0.6791***	0.7719***
	(0.0872)	(0.0991)	(0.1044)	(0.1200)
Debt reduction		-0.0214***		-0.0170*
		(0.0077)		(0.0101)
Psuedo R^2	0.245	0.249	0.347	0.348
Observations	3,399	2,558	3,417	2,515

Note: Constant terms are included but not reported. Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at the levels of 1%, 5% and 10%, respectively.

TABLE 5

Matching Estimate of the Treatment Effect on Borrowing Costs: Numerical Rule on Fiscal Balance

	Matching methods						
	Nearest neighbour matching	Three-nearest neighbour matching	Radius matching			Local linear regression matching	Kernal matching
			r=0.1	r=0.03	r=0.05		
Panel A. Treatment effect of fiscal balance rule on international bond spreads							
1. Baseline ATT	-0.0177**	-0.0157**	-0.0170**	-0.0159**	-0.0158**	-0.0149**	-0.0159**
	(0.0062)	(0.0060)	(0.0055)	(0.0054)	(0.0054)	(0.0050)	(0.0053)
2. Including debt relief ATT	-0.0167**	-0.0164***	-0.0171**	-0.0164***	-0.0160***	-0.0150**	-0.0161**
	(0.0055)	(0.0054)	(0.0059)	(0.0054)	(0.0053)	(0.0055)	(0.0050)
3. High-income countries only ATT	-0.0131**	-0.0147**	-0.0167**	-0.0165**	-0.0188**	-0.0166***	-0.0163***
	(0.0065)	(0.0065)	(0.0063)	(0.0056)	(0.0070)	(0.0054)	(0.0053)
4. Developing countries only ATT	-0.0101**	-0.0057	-0.0083**	-0.0089**	-0.0095***	-0.0105***	-0.0093**
	(0.0037)	(0.0035)	(0.0029)	(0.0031)	(0.0031)	(0.0311)	(0.0031)
5. Excluding Eurozone countries ATT	-0.0122**	-0.0127**	-0.0129**	-0.0089	-0.0103	-0.0071*	-0.0088*
	(0.0059)	(0.0063)	(0.0060)	(0.0067)	(0.0065)	(0.0048)	(0.0046)
6. Excluding USA, UK, Japan, Germany ATT	-0.0151**	-0.0165***	-0.0161***	-0.0146**	-0.0160**	-0.0140**	-0.0144**
	(0.0059)	(0.0054)	(0.0054)	(0.0054)	(0.0060)	(0.0051)	(0.0054)
7. 5-year average data: baseline estimate ATT	-0.0223*	-0.0273**	-0.0237*	-0.0237*	-0.0259*	-0.0211*	-0.0252*
	(0.0122)	(0.0134)	(0.0139)	(0.0139)	(0.0149)	(0.0121)	(0.0146)
Panel B. Treatment effect of fiscal balance rule on domestic borrowing spreads							
1. Baseline ATT	0.0150***	0.0185***	0.0175***	0.0168***	0.0163***	0.0156***	0.0164***
	(0.0050)	(0.0053)	(0.0054)	(0.0051)	(0.0048)	(0.0050)	(0.0048)
2. Including debt relief ATT	0.0145**	0.0169**	0.0172***	0.0164***	0.0162***	0.0154***	0.0162***
	(0.0061)	(0.0057)	(0.0055)	(0.0051)	(0.0047)	(0.0050)	(0.0051)
3. High-income countries only ATT	0.0151**	0.0140**	0.0161**	0.0163***	0.0161***	0.0161***	0.0159***
	(0.0077)	(0.0061)	(0.0061)	(0.0052)	(0.0054)	(0.0047)	(0.0051)
4. Developing countries only ATT	0.1102*	0.1151**	0.0936*	0.0836*	0.0775	0.0663**	0.0794**
	(0.0608)	(0.0549)	(0.0512)	(0.0433)	(0.0562)	(0.0340)	(0.0401)
5. Excluding Eurozone countries ATT	0.0124**	0.0126**	0.0132**	0.0092*	0.0087	0.0074*	0.0091*
	(0.0057)	(0.0062)	(0.0056)	(0.0053)	(0.0065)	(0.0041)	(0.0050)
6. Excluding USA, UK, Japan, Germany ATT	0.0155***	0.0164***	0.0165***	0.0151***	0.0146**	0.0145**	0.0148***
	(0.0051)	(0.0051)	(0.0049)	(0.0047)	(0.0049)	(0.0051)	(0.0048)
7. 5-year average data: baseline estimate ATT	0.0260*	0.0302**	0.0273*	0.01263*	0.0290**	0.0245**	0.0282**
	(0.0143)	(0.0136)	(0.0169)	(0.0052)	(0.0138)	(0.0124)	(0.0136)

Note.: A 0.06 fixed bandwidth and an Epanechnikov kernal are used for kernal and local lnear regession matching. Bootstraaped standard errors are reported in parenthesis. International borrowing spreads are the spread between the interest rate at which a country borrows and the "risk free" rate, defined as the yield on long-term US Treasury bonds. Domestic borrowing spreads are the spread between the interest rate charged by domestic banks on loans to private sector entities and the interest rate at which governments can borrow through the issuance of short-term securities.

***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6

Matching Estimate of the Treatment Effect on Borrowing Costs: Numerical Rule on Public Debt

	Matching methods						
	Nearest neighbour matching	Three-nearest neighbour matching	Radius matching			Local linear regression matching	Kernal matching
			r=0.1	r=0.03	r=0.05		
Panel A. Treatment effect of public debt rule on international bond spreads							
1. Baseline ATT	-0.0115**	-0.0121***	-0.0115**	-0.0104**	-0.0105**	-0.0109**	-0.0106**
	(0.0045)	(0.0040)	(0.0041)	(0.0039)	(0.0037)	(0.0040)	(0.0037)
2. Including debt relief ATT	-0.0132**	-0.0127*	-0.0171**	-0.0115**	-0.0103**	-0.0106**	-0.0103**
	(0.0043)	(0.0043)	(0.0059)	(0.0044)	(0.0040)	(0.0039)	(0.0039)
3. High-income countries only ATT	-0.0122***	-0.0116***	-0.0083**	-0.0067*	-0.0063*	-0.0063*	-0.0061*
	(0.0040)	(0.3611)	(0.0038)	(0.0035)	(0.0033)	(0.0035)	(0.0034)
4. Developing countries only ATT	-0.0079***	-0.0066***	-0.0056***	-0.0048***	-0.0034**	-0.0014	-0.0037**
	(0.0021)	(0.0020)	(0.0017)	(0.0016)	(0.0016)	(0.0018)	(0.0017)
5. Excluding Eurozone countries ATT	-0.0067**	-0.0065**	-0.0056**	-0.0050**	-0.0042**	-0.0027	-0.0045**
	(0.0027)	(0.0024)	(0.0023)	(0.0021)	(0.0021)	(0.0018)	(0.0021)
6. Excluding USA, UK, Japan, Germany ATT	-0.0058**	-0.0075*	-0.0086**	-0.0096**	-0.0081**	-0.0097**	-0.0085**
	(0.0039)	(0.0041)	(0.0038)	(0.0035)	(0.0036)	(0.0036)	(0.0037)
7. 5-year average data: baseline estimate ATT	-0.0228*	-0.0198*	-0.0270*	-0.0182*	-0.0187*	-0.0133*	-0.0187*
	(0.0131)	(0.0116)	(0.0152)	(0.0100)	(0.0101)	(0.0073)	(0.0100)
Panel B. Treatment effect of public debt rule on domestic lending spreads							
1. Baseline ATT	0.0125***	0.0140***	0.0124***	0.0113**	0.0113***	0.0117***	0.0114***
	(0.0043)	(0.0038)	(0.0039)	(0.0039)	(0.0037)	(0.0036)	(0.0037)
2. Including debt relief ATT	0.0154***	0.0132***	0.0120***	0.0112**	0.0111***	0.0115***	0.0111***
	(0.0044)	(0.0041)	(0.0038)	(0.0039)	(0.0037)	(0.0036)	(0.0036)
3. High-income countries only ATT	0.0135***	0.0123***	0.0095**	0.0079**	0.0076**	0.0074**	0.0075**
	(0.0039)	(0.0037)	(0.0036)	(0.0034)	(0.0034)	(0.0033)	(0.0032)
4. Developing countries only ATT	0.0735*	0.0828	0.1023*	0.1230***	0.1171**	0.1673***	0.1186***
	(0.0420)	(0.0631)	(0.0057)	(0.0040)	(0.0039)	(0.0052)	(0.0039)
5. Excluding Eurozone countries ATT	0.0030	0.0052*	0.0059*	0.0067*	0.0057*	0.0070**	0.0060*
	(0.0042)	(0.0028)	(0.0035)	(0.0035)	(0.0033)	(0.0035)	(0.0034)
6. Excluding USA, UK, Japan, Germany ATT	0.0058	0.0078*	0.0091**	0.0099***	0.0086**	0.0105***	0.0090**
	(0.0045)	(0.0042)	(0.0038)	(0.0033)	(0.0035)	(0.0035)	(0.0034)
7. 5-year average data: baseline estimate ATT	0.0241*	0.0222**	0.0298*	0.0181*	0.0191*	0.0164	0.0180*
	(0.0127)	(0.0113)	(0.0170)	(0.0113)	(0.0117)	(0.0104)	(0.0106)

Note.: A 0.06 fixed bandwidth and an Epanechnikov kernal are used for kernal and local lnear regession matching. Bootstraaped standard errors are reported in parenthesis. International borrowing spreads are the spread between the interest rate at which a country borrows and the "risk free" rate, defined as the yield on long-term US Treasury bonds. Domestic borrowing spreads are the spread between the interest rate charged by domestic banks on loans to private sector entities and the interest rate at which governments can borrow through the issuance of short-term securities.

***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Figure 1
International bond spreads in countries with and without fiscal rules

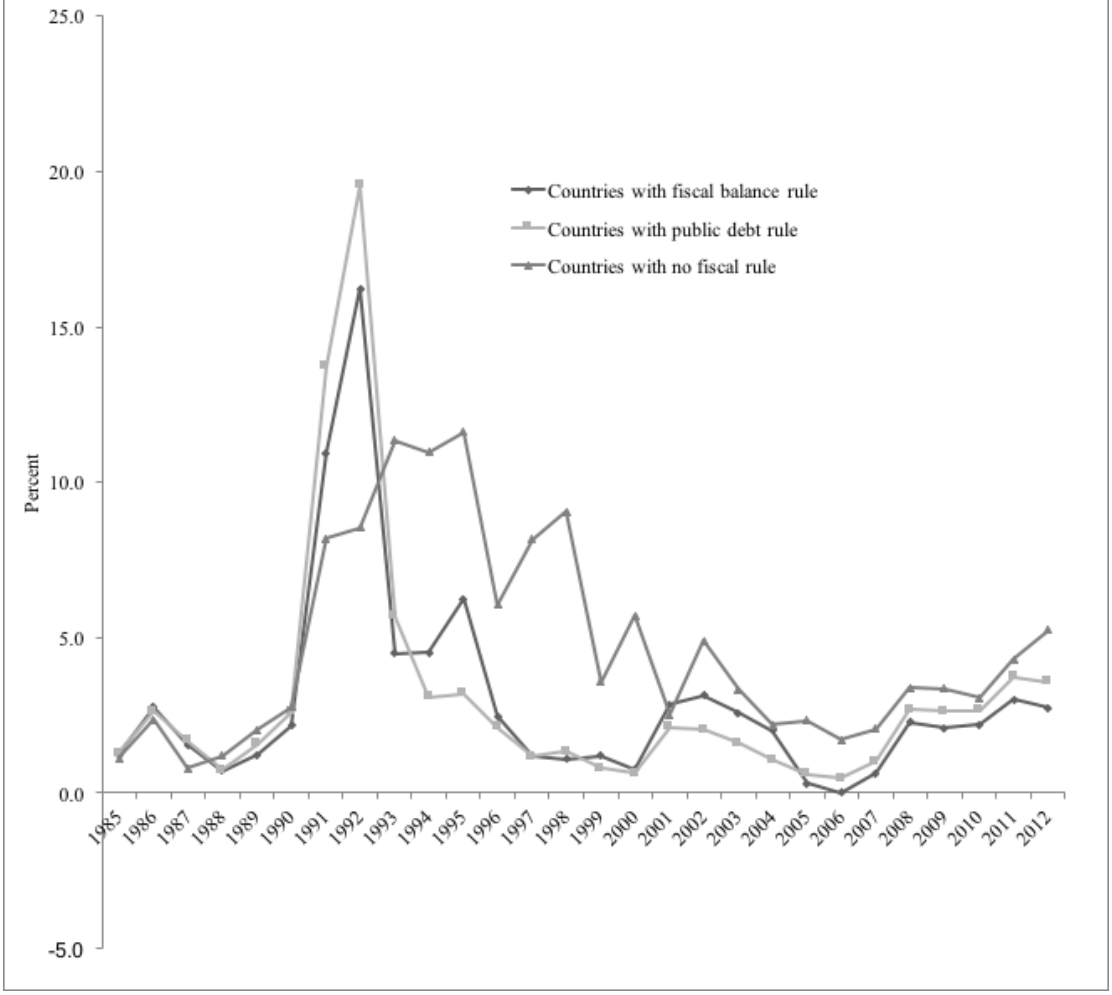

Figure 2
Domestic borrowing spreads in countries with and without fiscal rules